Module 2a: Identifying alternative chemical synthesis pathways: Green Chemistry

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Module 2a: Identifying alternative chemical synthesis pathways: Green Chemistry

- Educational goals and topics covered in the module
- Potential uses of the module in chemical engineering courses
- Student handouts
- Instructor materials and textbook
- Software
- Case studies

Module 2a: Educational goals and topics covered in the module

Students will:

- become familiar with methods for identifying alternative chemical synthesis pathways
- become aware of chemical properties and functional groups that are of concern in selecting synthesis methods
- examine case studies of alternative chemical syntheses

Module 2a: Potential uses of the module in chemical engineering courses

- Design course: Use as a preliminary screening tool in selecting process design
- Courses on Industrial chemistry, polymers, electronic materials: Module on environmental impacts

Module 2a: Student handouts

- Chapter 7 from textbook (still being drafted)
- Class lecture notes designed so that instructor writes in key concepts and calculations during the lecture

Module 2a: Instructor materials

- Completed class lecture notes: contains material that the instructor writes into the notes during the lecture

Module 2a: Software

GREEN CHEMISTRY EXPERT SYSTEM -

Topics covered:

- Synthetic Methodology Assessment for Reduction Technologies (SMART)
- Green Synthetic Reactions
- Designing Safer Chemicals
- Green Solvents/Reaction Conditions
- Green Chemistry References

Green Chemistry Expert System

- Synthetic Methodology Assessment for Reduction Technologies (SMART)

This module contains a program designed to assess the environmental impact of a given process. This program calculates and categorizes the wastes generated in a process and indicates the Environmental Protection Agency's level of concern arising from the results.

- Green Synthetic Reactions

The Green Synthetic Reactions module is a database containing examples of selected synthetic processes. These processes have been chosen as examples of green chemistry alternatives to replace standard industrial syntheses. The user can search the database by pollution prevention comments (e.g., safety, inexpensive), key word(s), status (e.g., lab scale, pilot plant, patent), or reference.

Green Chemistry Expert System

- Designing Safer Chemicals

The Designing Safer Chemicals module provides information on how compounds can be designed to minimize hazards. Based on structure-activity relationships, this module provides qualitative estimates of the hazard of a particular chemical in the classes covered, discusses the mechanism of toxicity for the class of chemicals, if known, and helps predict which structural modifications may reduce the overall toxicity of a chemical. This module is intended to be used as a tool for assessing relative toxicities of chemicals within a class so that you may more easily consider toxicity as a factor when choosing or designing chemicals for a process.

Green Chemistry Expert System

- Green Solvents/Reaction Conditions

The Green Solvents and Reaction Conditions module includes brief descriptions of some alternative solvents and reaction conditions, a database of examples, and a compilation of physical-chemical properties for over 600 solvents. This database is designed to provide selected data to compare the properties of many solvents, in order to facilitate locating suitable alternative solvents for a process that uses a hazardous solvent. Data on EPA regulatory lists, Global Warming Potential, and Ozone Depletion Potential are included to provide you with some hazard information. You can search the database by a combination of boiling point, melting point, and water solubility.

- Green Chemistry References

This module contains references to environmentally friendly chemistry. You can search for a particular reference or you can browse references by category and subcategory.

GREEN CHEMISTRY EXPERT SYSTEM: Software Demonstration

www.epa.gov/greenchemistry